XXII. *Calculations of some observations of the solar eclipse on the 7th of September, 1820.* By Mr Charles Rumker. *Communicated by* Thomas Young, *M. D. For. Sec. R. S.*

Read May 10, 1821.

BE / EE signifies Beginning / End of the Eclipse. BR / ER signifies Beginning / End of the Ring.

Place of Observation.	Latitude.	Long. in Time from Greenwich.	Observer.	Phase.	Instant of Observation in Mean Time.	Conjunction in Mean Time.	Coefficients of the Corrections.
Nienstedten . .	53 33 10	39 25 E	Schumacher	B. E.	1 10 38,5	2 29 30,5	—0,5846dL+2,2958d(R+r)+0,1994dp.
Bremen . . .	53 4 38	35 12	Olbers	B. R.	2 29 24	2 25 21,1	+0,0403dL+2,221 d(R—r)—0,1542dp.
				E. R.	2 34 41,5	2 24 55,5	—1,245 —2,545 d(R—r)+0,8942
				E. E	3 52 13	2 25 4,8	—0,5706 —2,292 d(R+r)+0,12015
Göttingen . . .	51 31 56	39 47	Gauss	B. R.	2 28 11,1	2 29 59,2	+0,047dL +2,2207d(R—r)—0,2386. dp.
				E. E.	4 0 39,0	2 29 32,4	—0,5731 —2,293 d(R+r)+0,0461.
Berlin	52 31 15	53 31,5	Bode	E. E.	4 13 44,7	2 43 16,4	—0,6351dL—2,310 d(R+r)+0,11421dp.
Bologna . .	44 30 12	45 26	de Zach	B. E.	1 35 31,3	1 35 30,51	—0,7876dL+2,3557d(R+r)+0,4612 dp.
				E. R.	3 5 0,32	2 35 20,42	+1,5174dL—2,6891d(R—r)—1,7192
Genoa . . .	44 24 34	35 47	Ruppel	E. E.	4 11 59	2 25 34,3	—0,4579dL—2,2669d(R+r)—0,3458 dp.
Copenhagen . .	55 40 55	50 20	Ursin	B. E.	1 51 20,2	2 40 32,4	—0,4614dL+2,2676d(R+r)+0,1300 dp.
				E. E.	4 3 22,1	2 40 11,5	—0,6500 —2,3134 +0,2675.
Cuxhaven . . .	53 52 40	34 51	Tralles	B. E.	1 4 10,4	2 24 55,5	—0,6087dL+2,302 d(R+r)+0,7319 dp.
				B. R.	2 27 25	2 24 57,6	+0,3360 +2,245 d(R—r)—0,370
				E. R.	2 32 27,0	2 24 33,3	—1,628 —2,752 +1,2506
				E. E.	3 49 58,7	2 24 41,1	—0,5743 —2,293 d(R+r)+0,1585
Hamburg . . .	53 33 8	39 58	Rumker	E. E.	3 56 27,9	2 29 47,5	—0,5931dL—2,298 d(R+r)—0,1489 dp.
Manheim . . .	49 29 18	33 53	Nicolai	B. R.	2 35 25,5	2 23 49	—2,549 dL+3,380 d(R—r)+1,807 dp.
				E. R.	2 40 21,6	2 23 44,4	+0,6986 —2,3275d(R—r)—0,8319 dp.
				E. E.	3 58 34,5	2 23 41,4	—0,5246 —2,280 d(R+r)—0,0687 dp.
Near Cork, 20″ East thereof in Time.	51 55 31	33 36W	Brisbane	B. E.	11 38 30,6	1 16 21,94	—1,2222dL+2,5343d(R+r)+1,48539dp.
				E. E.	2 32 26,1	1 16 17,27	—0,2173 —2,2308d +0,02515
Bushy Heath, Stanmore . . .	51 37 44,3	1′ 21″	Beaufoy	B. E.	0 22 57	1 48 47,69	—0,9545dL+2,4166d(R+r)+1,11705dp.
				E. E.	3 14 57	1 48 28,55	—0,3875 —2,2538d +0,0142
Greenwich . .	51 28 40	0 0	Pond	B. E.	0 22 37	1 50 0,6	—0,9507dL+2,4151d(R+r)+1,1027. dp.
				E. E.	3 14 40	1 49 43,8	—0,39215 —2,2555 +0,00999
Blackheath . .	51 28 2	0 0,3 E	Groombridge	E. E.	3 14 32,8	1 49 40,4	—0,3906dL—2,2547d(R+r)+1,01004dp.
Kentish Town . .	51 33 34	0 35,2 W	F. Baily	B. E.	0 21 42,4	1 49 24,64	—0,9526dL—2,4159d(R+r)+1,11002dp.
				E. E.	3 13 41,1	1 49 7,78	—0,3896 —2,254 +0,0107
Zurich Observatory	47 22 27	34 11 E	Freer	B. R.	2 42 15,03	2 24 17,68	Diff. of Radii 65,59. Diff. of Latitudes 65,67.
				E. R.	2 43 49,8	2 24 14,74	+3,629 dL—4,2553 d(R—r)—3,16dp.
Zurich Town . .	. . .	. . .	Horner	B. R.	2 42 3,88	2 24 9,06	Diff. of Radii 65,59. Diff. of Latitudes 66,81.
				E. R.	2 43 41,42	2 24 11,47	+3,846dL—4,4408d(R—r)—8,46dp.
Amsterdam . . .	52 22 17	19 33 E	Greve	B. R.	2 13 30,5	2 9 39,19	Diff. of Radii 65,58. Diff. of Latitudes 67,142.
				E. R.	2 14 24,5	2 9 32,4	—6,1821dL—6,5686d(R—r)+5,03097dp.
Bergen	60 23 38	21 24 E	Bohr	B. R.	1 58 53,23	2 11 17,49	+1,0562dL+2,4586d(R—r)—8,708dp.
				E. R.	2 2 54,08	2 10 41,41	—2,554 —3,3841 +2,3537.

From the three following observations of Doctor OLBERS, I calculated the elements of the comet in the Pegasus 1821.

	Mean Time at Bremen.	Comets appar. AR.	Ditto, declination, North.
January 30	7° 17′ 51″	359 27 4	16 5 1
February 19	6 49 20	357 59 48	14 48 10
March 6	6 56 20	356 46 33	13 34 21

Thence I find

Transit over the perihelion, March,	21,6114625 mean time at Bremen.
Long. of the perihelion	239° 35′ 53″ upon the orbit.
Long. of the d. Node	48 44 18
Inclination of the orbit	73 20 00
Log. perihelion distance	8,9651463.
Motion retrograde.	

These calculations are founded upon BURCKHARDT's lunar and CARLINI's solar tables.

From the former, the moon's place for mean noon at Paris, on the 7th of September 1820, was found.

	s.	°	′	″
Moon's apparent longitude -	5	13	49	24,13
Latitud -			49	59,46
Equation, horizontal parallax -			53	53
Moon's semidiameter - -			14	41
CARLINI's solar table give ⊙ latitude +				0,44
Horizontal parallax - - -				8,76
Semidiameter - - -			15	54,8

Ratio of the axes of the earth 302,8 : 303,8.

The above calculations resolved after the method of the least squares (Methode des moindres carrés) give for the error of BURCKHARDT's lunar table

$d.\ \text{Lat.} = -3'',975$; $d(\text{R}-r) = -3,768$ $d(\text{R}+r) = -3,497$.

The semidiameter of the sun at a solar eclipse is therefore to be diminished by 3 ,632.* The semi-diameter of the moon appears not to require any correction after BURCKHARDT's tables.

These corrections being applied to the former calculations, we obtain the following results. The places of observations are ranged in the order in which they follow in longitude from east to west.

Place of observation.	Phase observed.	Conjunction corrected.
Moskwa -	Beginning of the eclipse	4 20 38,06.
Berlin - -	End of the eclipse	2 43 27,0
Copenhagen	Beginning of the eclipse	2 40 26,09.
	End of the eclipse	2 40 22,16.
Bologna -	Beginning of the eclipse	2 35 25,38.
	End of the ring	2 35 24,58.
Hamburg -	End of the eclipse	2 29 57,9.
Göttingen -	Beginning of the ring	2 29 43,57.
	End of the eclipse	2 29 42,73.
Nienstedten	Beginning of the eclipse	2 29 24,77.
Genoa - -	End of the eclipse	2 25 44,53.
Bremen -	Beginning of the ring	2 25 12,57.
	End of the ring	2 25 10,04.
	End of the eclipse	2 25 15,07.
Cuxhaven	Beginning of the eclipse	2 24 49,86.
	Beginning of the ring	2 24 47,805.
	End of the ring	2 24 50,14.
	End of the eclipse	2 24 51,39.
Zurich Observatory -	Beginning of the ring	2 24 17,68.
	End of the ring	2 24 16,35.

* This agrees with DU SEJOUR's allowance for irradiation; but the correction —3″,5 which he applied to the ☾'s semidiameter on account of inflexion, may have arisen from the imperfect state of the lunar tables.

Place of observation.	Phase observed.	Conjunction corrected.
Manheim -	Beginning of the ring	2 23 46,40.
	End of the ring	2 23 50,47.
	End of the eclipse	2 23 51,46.
Bergen -	Beginning of the ring	2 11 4,03.
	End of the ring	2 11 4,31.
Greenwich	Beginning of the eclipse	1 49 55.9.
	End of the eclipse	1 49 58,23.
Kentish Town	Beginning of the eclipse	1 49 19,97.
	End of the eclipse	1 49 17,22.
Bushey Heath	Beginning of the eclipse	1 48 43,02.
	End of the eclipse	1 48 38,00.
Near Cork	End of the eclipse	1 16 25,93.

Allowing the longitudes of the following places to be well ascertained, Greenwich = 0, Göttingen 39′ 47″, Manheim 33′ 53″, Bremen 35′ 12″, Copenhagen 50′ 20″, Berlin 53′, 31″,5, this solar eclipse may serve to fix the longitudes of the other places, comparing the same phases observed on different spots with one another.

Thus I find the longitude of Cuxhaven.

Phase.	Beginning of eclipse.	Beginning of the ring.	End of the ring.	End of eclipse.
Compared with	Green. 34 53,96	Gotting. 34 51,23	Brem. 34 52,1	Berlin 34 55,9
		Brem. 34 47,23	Manh. 34 52,7	Gott. 34 55,66
		Manh. 34 54,40		Green. 34 53,16
			34 52,38	Copen. 34 49,23
		Mean 34 50,97		Manh. 34 52,93
				Brem. 34 48,32
				Mean 34 52,53

Hence the longitude of Cuxhaven is found 34′ 52″,46 in time, east. In the same manner the longitudes of the following places have been deduced.

	°	′	″	
Moskwa, longitude - -	2	30	42,16	East.
Bologna - - -	0	45	27,71.	
Hamburg - -		39	59,04.	
Nienstedten - - -		39	28,87.	
Genoa - - -		35	45,67.	
Cuxhaven - -		34	52,46.	
Zurich - - -		34	19,7.	
Bergen - - -		21	6,86.	
Amsterdam - - -		19	38,49.	
Kentish Town - -		0	40,82	West.
Bushey Heath - -		1	19,7.	
Cork - - -		3	52,93.	